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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,607	03/29/2004	Sang Hun Lee	42P19028	2832

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EXAMINER	
NGUYEN, THONG Q	
ART UNIT	PAPER NUMBER
2872	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/811,607	LEE ET AL.	
	Examiner	Art Unit	
	Thong Nguyen	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9-23,25 and 26* is/are rejected.

7)☒ Claim(s) *8 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Petition

1. The petition for revival of an application for patent abandoned unintentionally under 37 CFR 1.137() filed by applicant has been received by the office on 8/8/08. The Petition is granted and an Office action related to the Petition has been mailed to applicant on 9/2/08.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection mailed to applicant on 10/25/06 and the Notice of non-compliant mailed to applicant on 6/8/2007. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/8/08 has been entered.

Response to Amendment

3. The present Office action is made in response to amendment filed by applicant on 8/8/08. It is noted that in the amendment, applicant has amended claims 1-26. There is not any claim being added or canceled from the application. The pending claims 1-26 are examined in this Office action.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 6, 9-10 and 17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a) Claim 6 is indefinite by the recitation thereof "the structure comprising: Molybdenum having a thickness of 2.4 – 11.3 nm alternating with Silicon having a thickness of 3.5 – 10.4 nm in the bi-layers" (lines 2-4) is indefinite. It is noted that since the Molybdenum and Silicon each is name of material, thus it is not understood why each mentioned material has a range of thickness as claimed. Should the mentioned recitation be changed to --each bi-layers comprises a layer of Molybdenum having a thickness in the range of 2.4 – 11.3 nm and a layer of Silicon having a thickness in the range of 3.5 – 10.4 nm-- to make clear the feature claimed?

b) Claim 9 is rejected under 35 USC 112, second paragraph because the feature thereof "the extra thick layer of Molybdenum is in bi-layer no. 1" (lines 1-2) is indefinite. What does applicant mean by "bi-layer no. 1"? Applicant should further note that the base claim 1, on lines 4-5 recites that the extra layer of Molybdenum is positioned next to the substrate. Thus, it is unclear about the structural relationships among the so-called "bi-layer no. 1", the layer of Molybdenum positioned next to the substrate and other layers of the mirror?

c) Claim 10 is rejected for the similar reason as set forth in element b) above. In other words, the feature thereof "the extra thick layer of Silicon is in bi-layer no. 3" (lines 1-2) is indefinite. What does applicant mean by "bi-layer no. 3"? Thus,

it is unclear about the structural relationships among the so-called "bi-layer no. 3", the substrate and other layers of the mirror?

d) Claim 17 is rejected under 35 USC 112, second paragraph for the similar reason as set forth in element a) above.

Claim Rejections - 35 USC § 103

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1-5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al (EP 1348984, of record) in view of Early et al (U.S. Patent No. 5,265,143).

Yakshin et al disclose an optical broad band element. The element as described in pages 3-4 and 6 and shown in figures 2 and 4-6 comprises a multilayer mirror for reflecting light in an extreme ultraviolet wavelength. In particular, the multilayer mirror comprises a substrate and a set of alternative layers formed on the substrate. See pages 2-3. Regarding to the range of angles which the mirror reflects with a uniform level and increases small phase shifts as recited in claims 2 and 4, the mirror as provided by Yakshin et al can provide a uniform reflection of extreme ultraviolet wavelength of 13.4 nm up to 20 degrees without a significant loss of reflectivity and change in phase shift. See pages 3 and 4, section [0032], for example. The multilayers formed on the substrate of the mirror as provided by Yakshin et al are constituted by Mo/Si bi-layers.

Regarding to the value of the loss in reflectivity as recited in present claim 3, such feature is read in the data provided in the figures 5 and 6 in comparison with the data provided in figure 4 of the present application. In other words, the difference in reflectivity at the angle of 18 degrees and that of 20 degrees as shown in each of figures 5 and 6 is about 20 % which is closed to the value as provided in the figure 4 of the present application. The thickness of the layers as provided by Yakshin et al is able to change as can be seen in pages 3-4, section [0031], for example. It is noted that since a change in thickness will yield a change in optical characteristics including the change in the reflective level of the mirror, then it would have been obvious to one skilled in the art at the time the invention was made to modify the multilayer mirror as provided by Yakshin et al by adjusting the thicknesses of the layers to reduce the loss of the reflectivity of the mirror in a desired/particular range or value.

The only feature missing from the Mo/Si multilayered mirror provided by Yakshin et al is that they do not explicitly state the use of an extra layer of Molybdenum, hereafter, Mo, layer next to the substrate of the mirror as claimed.

However, the use of a barrier layer disposed between a substrate and a multilayer in an optical element for use in an X-ray imaging system is known to one skilled in the art as can be seen in the optical device provided by Early et al. In particular, in columns 6-7 and shown in fig. 2, Early et al disclose an optical element having a substrate (10), a multilayer (60) made by a multiple layers of Mo/Si alternated arranged , and a barrier layer (50) disposed between the

substrate (10) and the multilayer (60). Regarding to thickness of the barrier layer, in column 7, lines 16-29, Early et al disclose that the layer has a thickness in the range of 100-1000 Armstrong. They also suggest that the thickness of the layer could be made thicker to reduce the density of pinholes in the layer. It is also noted that the figure 2 has clearly shown that the barrier layer (50) has a thickness which is larger than the thickness of each layer constituted the multilayer (60).

Regarding to the material of the barrier layer, in columns 7-8, Early et al disclose that the material of the layer can be carbon or ruthenium. Early et al do not explicitly state that the material of the barrier layer is Mo as claimed. However, it would have been obvious to one skilled in the art at the time the invention was made to utilize any suitable material including Mo material which is available in the market to make the barrier layer in the combined product provided by Yakshin et al and early et al for the purpose of satisfying/meeting a particular application/design. See In re Leshin, 125 USPQ 416; KSR International Co. v. Teleflex Inc., 550 U.S., 82 USPQ 2d 1385 (2007).

8. Claim 6, as best as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al in view of Early et al as applied to claim 1 above, and further in view of Montcalm et al (U.S. Patent No. 5,958,605, of record).

The only feature missing from the combined product as provided by Yakshin et al and early et al is that it does not explicitly state the thickness of the Mo layers and the Si layers as claimed. However, the use of a Mo/Si multilayered mirror in

an extreme ultraviolet or soft X-ray application wherein the thicknesses of the Mo layers and Si layers in the claimed ranges is known to one skilled in the art as can be seen in the system provided by Montcalm et al. In particular, Montcalm et al disclose a multilayered mirror having 40 to 100 alternative Mo/Si layers, column 3, lines 3-7, and teach that the thickness of the Mo layer is 2.8 nm and the thickness of the Si layer is 4.0 nm, see column 5, lines 2-4. It is also noted that a change in thickness of the Mo layers and Si layers is clearly disclosed by Yakshin et al as can be seen in section [0031]. Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify the combined product as provided by Yakshin et al and Early et al by using Mo layers having thickness of 2.8 nm and Si layers having thickness of 4.0 nm as suggested by Montcalm et al and varying the thicknesses of the layers as disclosed by Yakshin et al for the purpose of increasing the reflectivity intensity and maintaining the stability of the mirror.

9. Claims 11-16, 18-23, and 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al (EP 1348984, of record) in view of Early et al (U.S. Patent No. 5,265,143) and Mann et al (Pub. US 2003/0099034, of record)..

Yakshin et al disclose an optical broad band element. The element as described in pages 3-4 and 6 and shown in figures 2 and 4-6 comprises a multilayer mirror for reflecting light in an extreme ultraviolet wavelength. In particular, the multilayer mirror comprises a substrate and a set of alternative layers formed on the substrate. See pages 2-3. Regarding to the range of angles which the mirror

reflects with a uniform level and increases small phase shifts as recited in claims 13 and 15, the mirror as provided by Yakshin et al can provide a uniform reflection of extreme ultraviolet wavelength of 13.4 nm up to 20 degrees without a significant loss of reflectivity and change in phase shift. See pages 3 and 4, section [0032], for example. The multilayers formed on the substrate of the mirror as provided by Yakshin et al are constituted by Mo/Si bi-layers.

Regarding to the value of the loss in reflectivity as recited in present claim 14, such feature is read in the data provided in the figures 5 and 6 in comparison with the data provided in figure 4 of the present application. In other words, the difference in reflectivity at the angle of 18 degrees and that of 20 degrees as shown in each of figures 5 and 6 is about 20 % which is closed to the value as provided in the figure 4 of the present application. The thickness of the layers as provided by Yakshin et al is able to change as can be seen in pages 3-4, section [0031], for example. It is noted that since a change in thickness will yield a change in optical characteristics including the change in the reflective level of the mirror, then it would have been obvious to one skilled in the art at the time the invention was made to modify the multilayer mirror as provided by Yakshin et al by adjusting the thicknesses of the layers to reduce the loss of the reflectivity of the mirror in a desired/particular range or value.

Regarding to the number of layers as recited in claims 19 and 26, it would have been obvious to one skilled in the art to use a number of particular bilayers including the number of 36 bilayers for meeting a particular application.

The only feature missing from the Mo/Si multilayered mirror provided by Yakshin et al is that they do not explicitly state the use of an extra layer of Molybdenum, hereafter, Mo, layer next to the substrate of the mirror as claimed.

However, the use of a barrier layer disposed between a substrate and a multilayer in an optical element for use in an X-ray imaging system is known to one skilled in the art as can be seen in the optical device provided by Early et al. In particular, in columns 6-7 and shown in fig. 2, Early et al disclose an optical element having a substrate (10), a multilayer (60) made by a multiple layers of Mo/Si alternated arranged , and a barrier layer (50) disposed between the substrate (10) and the multilayer (60). Regarding to thickness of the barrier layer, in column 7, lines 16-29, Early et al disclose that the layer has a thickness in the range of 100-1000 Armstrong. They also suggest that the thickness of the layer could be made thicker to reduce the density of pinholes in the layer. It is also noted that the figure 2 has clearly shown that the barrier layer (50) has a thickness which is larger than the thickness of each layer constituted the multilayer (60).

Regarding to the material of the barrier layer, in columns 7-8, Early et al disclose that the material of the layer can be carbon or ruthenium. Early et al do not explicitly state that the material of the barrier layer is Mo as claimed. However, it would have been obvious to one skilled in the art at the time the invention was made to utilize any suitable material including Mo material which is available in the market to make the barrier layer in the combined product provided by

Yakshin et al and early et al for the purpose of satisfying/meeting a particular application/design. See In re Leshin, 125 USPQ 416; KSR International Co. v. Teleflex Inc., 550 U.S., 82 USPQ 2d 1385 (2007).

The combined product as provided by Yakshin et al and Early et al does not clearly state that the extreme ultraviolet or soft X-ray application contains a plurality of mirrors as claimed. However, the use of a multilayered mirror in an extreme ultraviolet application having a plurality of mirrors for imaging a mask onto a wafer is known to one skilled in the art as can be seen in the system provided by Mann et al. See pages 1-2 and 4-5. In particular, the system provided by Mann et al comprises six mirrors wherein the third mirror is a broad band multilayer mirror. See page 5. The multilayer mirror described in page 4 comprises forty alternative bilayers of Mo/Si for reflection light at 13.4 nm. While Mann et al do not clearly state that their system is used to reflect light at 13.5 nm as claimed; however, it would have been obvious to one skilled in the art to modify the system by shifting the peak reflectivity of the multilayer mirror from 13.4 nm to 13.5 nm to increase the change sensitivity by changing the thickness. Thus, it would have been obvious to one skilled in the art at the time the invention was made to utilize the combined product as provided by Yakshin et al and early et al in a system having six mirrors as provided by Mann et al for the purpose of improving the imaging of a mask onto a wafer with high quality.

10. Claim 17, as best as understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al in view of Early et al and Mann et al as applied to claim 11 above, and further in view of Montcalm et al (U.S. Patent No. 5,958,605, of record).

The only feature missing from the combined product as provided by Yakshin et al, Early et al and Mann et al is that it does not explicitly state the thickness of the Mo layers and the Si layers as claimed. However, the use of a Mo/Si multilayered mirror in an extreme ultraviolet or soft X-ray application wherein the thicknesses of the Mo layers and Si layers in the claimed ranges is known to one skilled in the art as can be seen in the system provided by Montcalm et al. In particular, Montcalm et al disclose a multilayered mirror having 40 to 100 alternative Mo/Si layers, column 3, lines 3-7, and teach that the thickness of the Mo layer is 2.8 nm and the thickness of the Si layer is 4.0 nm, see column 5, lines 2-4. It is also noted that a change in thickness of the Mo layers and Si layers is clearly disclosed by Yakshin et al as can be seen in section [0031]. Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify the combined product as provided by Yakshin et al, Early et al and Mann et al by using Mo layers having thickness of 2.8 nm and Si layers having thickness of 4.0 nm as suggested by Montcalm et al and varying the thicknesses of the layers as disclosed by Yakshin et al for the purpose of increasing the reflectivity intensity and maintaining the stability of the mirror.

Allowable Subject Matter

11. Claims 8 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. It is also noted that claims 9-10 which depends upon claim 8 would be allowable if rewritten to overcome the rejections under 35 USC 112, second paragraph.

12. The following is a statement of reasons for the indication of allowable subject matter:

> Each of claims 8 and 24 is allowable with respect to the prior art, in particular, the EP 1348984 and the U.S. Patent Nos. 5,265,143; 6,011,646 and 6.110,607 by the limitations related to the structure of the multilayers formed on the substrate. It is noted that while the use of a layer having a thickness next to the substrate is suggested in each of the mentioned U.S. Patents; however, the cited art does not disclose a multilayer formed on a substrate wherein the multilayer comprises an extra thick layer of Mo disposed next to the substrate and an extra thick layer of Silicon disposed near the substrate as claimed.

Response to Arguments

13. The amendments to the claims and applicant's arguments with respect to claims 1-26 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thong Nguyen whose telephone number is (571) 272-2316. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on (571) 272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Thong Nguyen/
Primary Examiner, Art Unit 2872